I CLAIM:

1. An apparatus for forming relief in a surface of a sheet, the apparatus comprising:

a first platen,

a second platen disposed in opposition to the first platen,

the first and second platens adapted to receive a portion of an elongate sheet of material therebetween,

an advance mechanism to advance the sheet relative the platens,

the first platen carrying at least one pixel element reciprocally movable relative the first platen towards the second platen to desired positions between a retracted position and an extended position,

an activation mechanism to move the pixel element between the retracted position and the extended position comprising an electrically induced strain material which generates displacement forces, and

a control mechanism to control the activation mechanism and advance mechanism whereby reciprocal movement of the at least one pixel element form a relief on the surface of the sheet.

2. An apparatus as claimed in claim 1 wherein the activation mechanism comprises a piezoelectric actuator.

3. An apparatus as claimed in claim 2 wherein the piezoelectric actuator incorporates an amplifying mechanism to amplify displacement of a piezoelectric material.

4. An apparatus as claimed in claim 3 wherein the amplifying mechanism is hydraulic.

5. An apparatus as claimed in claim 4 wherein the elongate sheet has a width, at least one pixel element is a row of pixel elements extending across the width of the sheet.

6. An apparatus as claimed in claim 5 wherein the pixel elements are activated to reciprocally move selectively while the advance mechanism advances the sheet.

7. An apparatus as claimed in claim 4 wherein the first platen including a carriage mechanism to move the at least one pixel element relative the second platen transverse to the direction of advance of the sheet.

8. An apparatus as claimed in claim 4 wherein the first platen comprises a roller journalled about an axis and having an outer surface carrying the at least one pixel element, the roller continuously rotating to successively bring each pixel element into engagement with the sheet.

9. A method of forming relief in a surface of a substrate comprising selectively reciprocally moving with a piezoelectric actuator, a relief forming head of a pixel element into and away from the surface of the sheet at different locations over an area of the sheet.

10. An apparatus for forming relief in a surface of a sheet, the apparatus comprising:

a first platen,

a second platen disposed in opposition to the first platen,

an input relief carried on the first platen,

the first and second platens adapted to receive a portion of an elongate sheet of thermoplastic material therebetween sandwiching the sheet between the platens such that contact of a surface of the sheet with the first platen forms an output relief in said surface of the sheet corresponding to the input relief,

an advance mechanism to advance the sheet relative the platens for successive forming of the output relief on the surface at different portions of the sheet,

the first platen comprising a plurality of pixel elements arranged adjacent each other in an array with each pixel element defining a segment of the input relief of the first platen,

each pixel element movable relative the first platen between a retracted position and an extended position,

an activation mechanism to move each pixel element between the retracted position and the extended position, and

a control mechanism to control the activation mechanism and advance mechanism whereby the input relief can be varied by the movement of the pixel elements to change the input relief with time and thus form different output reliefs on different portions of the surface of the sheet.

11. An apparatus as claimed in claim 10 wherein the elongate sheet has a width, the array of pixel elements extending across the width of the sheet.

12. An apparatus as claimed in claim 11 wherein forming of the output relief on the surface at different portions of the sheet comprises forming simultaneously across the width of the sheet over each different portion.

13. An apparatus as claimed in claim 12 wherein the elongate sheet is advanced between the platens parallel a longitudinal of the sheet and the output relief is sequentially formed on the surface at different portions of the sheet as the portions are sequentially advanced between the platens.

14. An apparatus as claimed in claim 13 wherein at least one of the platens comprises a roller extending across the width of the sheet and rotatable about an axis normal to the longitudinal of the sheet,

the roller rotatable about its axis with advance of the sheet between the platens.

15. An apparatus as claimed in claim 13 wherein the first platen comprises a roller extending across the width of the sheet and rotatable about an axis normal to the longitudinal of the sheet,

the roller rotatable about its axis with advance of the sheet between the platens,

the roller carrying the pixel elements for movement radially inwardly in movement to the retracted position and movement radially outwardly in movement to the extended position such that an outwardly directed surface of the roller carries the input relief,

the pixel elements arranged in the array on the roller in at least one row of pixel elements extending axially across the roller and across the width of the sheet,

with rotation of the roller each row of the pixel elements being rotated between an engaged sector in which the pixel elements of the row are engaged with the sheet and disengaged sector in which the pixel elements of the row are not engaged with the sheet,

the control mechanism changing the input relief by selectively moving pixel elements in each row when that row is in the disengaged sector.

16. An apparatus as claimed in claim 15 wherein the control mechanism changing the input relief by selectively moving pixel elements in each row when that row is in the disengaged sector.

17. An apparatus as claimed in claim 15 wherein

the pixel elements are arranged in the array on the roller in a plurality of rows of pixel elements,

each row extending axially across the roller across the width of the sheet,

the plurality of rows extending continuously about the entire circumference of the roller whereby the roller may continuously rotate with the sheet advancing at the same speed as the input relief for continuous forming of the output relief in the surface of the sheet with rotation of the roller.

18. An apparatus as claimed in claim 10 wherein:

each pixel member includes an elongate stem with a head at one end,

the head comprising the segment of the input relief of the first platen for that pixel member,

a chamber carried by the first platen for each pixel element,

the chamber having an outwardly directed open end,

the stem of each pixel element slidably received in its respective chamber for sliding relative the chamber between its retracted position and its extended position,

in the extended position the head of each pixel element extending from the open end of its respective chamber.

19. An apparatus as claimed in claim 18 wherein:

each chamber is defined within a housing for each pixel element,

each housing secured to the first platen.

20. An apparatus as claimed in claim 19 wherein the activation mechanism to move each pixel element between the retracted position and the extended position is coupled between the respective housing and the stem of each pixel element.

21. An apparatus as claimed in claim 20 wherein the activation mechanism to move each pixel element between the retracted position and the extended position is carried by the respective housing of each pixel element.

22. An apparatus as claimed in claim 18 wherein the activation mechanism to move each pixel element between the retracted position and the extended position is a piezoelectric actuator.

23. An apparatus as claimed in claim 13 wherein the platens are movable relative each other towards and away from each other between an embossing position in which sheet is sandwiched between the platens with the pixel elements engaging with the sheet and a withdrawn position in which the pixel elements are not engaged with the sheet,

the control mechanism changing the input relief by selectively moving pixel elements when the platen is in the withdrawn position.

24. An apparatus as claimed in claim 13 wherein the sheet comprises a thermoplastic material including heating means to heat the sheet to a temperature at which the sheet is permanently deformed by the first platen forming the output relief in said surface of the sheet, and cooling means to cool the sheet after the output relief has been formed in the said surface of the sheet.

25. A method of forming relief in a surface of a thermoplastic sheet comprising the steps of:

step (1): sandwiching a first portion of an elongate sheet of thermoplastic material between a first portion of first platen and a second platen disposed in opposition to the first platen such that contact of a surface of the first portion of the sheet with the first portion of the first platen forms a first output relief in said surface of the first portion of the sheet corresponding to a relief on the first portion of the first platen, and

step (2): removing the first portion of the first platen from contact with the sheet,

step (3): changing the relief on the first portion of the first platen to become different than the relief in an immediately preceding sandwiching step,

step (4): sandwiching between the first portion of first platen and the second platen disposed in opposition to the first platen a different portion of the elongate sheet of thermoplastic material that has not been sandwiched in a previous sandwiching step such that contact of a surface of the different portion of the sheet with the first portion of the first platen forms an output relief in said surface of the different portion of the sheet corresponding to the relief on the first portion of the first platen.

26. A method as claimed in claim 25 wherein, after step (4),

subsequently repeating steps (2) to (4).

27. A method of forming relief in a surface of a sheet comprising the steps of:

a sandwiching step (1) of sandwiching a first portion of an elongate sheet of thermoplastic material between a first portion of first platen and a second platen disposed in opposition to the first platen such that contact of a surface of the first portion of the sheet with the first portion of the first platen forms a first output relief in said surface of the first portion of the sheet corresponding to an input relief on the first portion of the first platen, and

a removing step (2) of removing the first portion of the first platen from contact with the sheet,

a sandwiching step (3) of sandwiching between the first portion of first platen and the second platen disposed in opposition to the first platen a different portion of the elongate sheet of thermoplastic material than has been sandwiched in a previous sandwiching step such that contact of a surface of the different portion of the sheet with the first portion of the first platen forms an output relief in said surface of the different portion of the sheet corresponding to the relief on the first portion of the first platen, and

subsequently repeating removing step (2) and sandwiching step (3),

wherein after carrying out at least one said removing step (2) and before carrying out a sandwiching step (3) immediately following said removing step (2), carrying out a changing step of changing the input relief on the first portion of the first

platen to become different than the input relief in the sandwiching step (3) immediately preceding said removing step (2).

28. A method as claimed in claim 27 wherein:

the first platen comprising a plurality of pixel elements arranged adjacent each other in an arrangement selected from a row and an array with each pixel element movable relative the first platen between a retracted position and an extended position,

each pixel element defining a segment of the input relief of the first platen which input relief varies dependant on the position of each pixel element between its retracted position and its extended position,

the changing step of changing the input relief on the first portion of the first platen comprising moving selected of the pixel elements to a desired position between its retracted position and its extended position.

29. A method as claimed in claim 27 including

providing each portion of the elongate sheet of thermoplastic material to be sandwiched in any sandwiching step (3) at a temperature at which the sheet will be permanently deformed by the first platen forming the output relief in said surface of the sheet, and cooling each portion of the sheet after the output relief has been formed in the said surface of that portion of the sheet to a temperature at which the sheet will be substantially permanently retain the output relief.

30. A method as claimed in claim 29 wherein the sheet is advanced relative the platens parallel a longitudinal of the sheet and the sheet has a width normal to the longitudinal,

said row or array extending entirely across the width of the sheet.